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MEMORANDUM FOR: Economic Defense Intelligence Committee

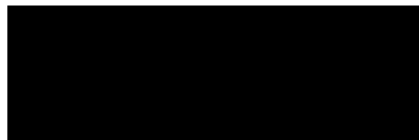
FROM : Chairman, EDIC

SUBJECT : The Petrochemical Industry in the USSR

REFERENCE : EDIC Case No. 30, SECRET

1. The attached intelligence document on the Petrochemical Industry in the USSR was prepared by CIA in response to the reference EDIC Case No. 30 initiated by the Department of Commerce. It is now distributed for review and acceptance by EDIC members.

2. If no request for committee discussion of this document is received prior to the close of business 1 August 1958 it will be regarded as approved and the case will be closed.



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Chairman

**Attachment:**

The Petrochemical Industry in the USSR

**Distribution:**

Cat B - (3-5, 8, 10)  
D - (All)  
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Deputy Director (Coordination)

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## THE PETROCHEMICAL INDUSTRY IN THE USSR

### A. Summary and Conclusions

One of the major tasks facing the USSR chemical industry is the development and expansion of the production of petrochemicals. The directives of the now defunct Sixth Five-Year Plan stated "it is one of the vital tasks of the chemical industry to raise drastically the utilization of petroleum, natural gases, and petroleum products for the production of synthetic rubber and alcohol, detergents, and other chemical products, with a view to reducing considerably the expenditure of grains, vegetable oils, and other kinds of food raw materials."

In the accelerated program for the chemical industry, announced in Khrushchev's report to the plenary session of the Central Committee of the CPSU held on 6-7 May 1958, there is to be continued emphasis on the utilization of petroleum and natural gases for petrochemical production, and large-scale capital investments are scheduled to provide the necessary plant, equipment, and technology.

Compared to the broadly based petrochemical industry in the United States, USSR production of petrochemicals is still in its infancy. Prior to 1952-1953, the USSR had no petrochemical industry at all, and the modern petroleum refining processes, using complex catalytic cracking and other advanced chemical techniques, which are basic to this industry, have not been fully mastered by Soviet engineers nor is the necessary equipment produced in the required quantities. The difficulties encountered in setting up a petrochemical operation are further compounded by the fact that, in general, chemical technology per se is not transferable to the petrochemical industry, so that an entirely new body of knowledge and experience relating specifically to petrochemistry must be accumulated before large-scale and diversified production can be undertaken. As a result, the growth of the Russian petrochemical industry to date has of necessity been slow and its output has thus far been restricted to a few of the most elementary products such as synthetic alcohol, acetone, and phenol. In short, the USSR does not as yet have a substantial basis - in terms of plant, equipment, and technology - for the creation of a highly complex petrochemical industry such as is required to support an advanced technology.

### B. Discussion

The Russians' initial interest in petrochemicals was derived from the need to replace foodstuffs as a major source for making alcohol required as a basic raw material in the synthetic rubber industry. In 1946, Stalin pointed out the urgency of this problem; however, it was seven years later before synthetic alcohol was produced commercially by a petrochemical process.

Soviet current interest is principally directed to the rapid expansion of the production of textiles, plastics, and of other materials based on petroleum sources. These products are basic to Soviet objectives of more and better

producers' goods, including defense items, and more consumers' goods. These objectives are the stated goals of the forthcoming Seven Year Plan (1959 - 1965). While tonnage figures have not been announced, in many cases (as expressed by percentage increases to be attained), plan goals appear to be to match 1957 production in the United States. Of the 100 billion rubles to be invested in the production and purchase of plant and equipment for the chemical industry during the period covered by the plan, a substantial part will be devoted to petrochemicals. The types of end-products involved are, in general, those which are in mass production in the United States. This is evident from the type of plants included in the USSR "shopping lists" currently under review by the US Department of Commerce.

According to a recent statement by the Deputy Minister of the Chemical Industry, the Soviets plan, in 1965, to use more than 2.5 million tons of liquid hydrocarbons from associated gases to produce chemical products. If, instead of these gases, food raw materials were used, it would require an expenditure of over 300 million poods of grain (1 pood = 36 lbs), of 13 million tons of potatoes. Thus the planners expect petrochemicals to become a major industry by 1965.

The key factors determining the degree to which these plans will be fulfilled are (a) the availability of equipment, and, (b) the availability of the necessary production know-how. At present the Bloc is short of equipment manufacturing capacity. More serious is the shortage of chemical engineering technology. Past experience has been that except for individual high-priority projects, such as "Sputnik," it normally takes from five to ten years, or even longer, for the Soviets to translate laboratory knowledge into commercial production. Current plans call for rapid expansion in many areas of the chemical industry. Even today, before the plan has started, there are many complaints of construction lags. Equipment deliveries are slow and the producers are blaming the engineers for their failure to furnish design data. Many processes used in the USSR chemical industry are deficient in mechanization and automation. The Communists hope to meet the tremendous increase in skilled-labor requirements, which their plans entail, by the general adoption of modern techniques. The purchase of the latest U.S. technology, as a part of the plants under discussion, would enable the USSR to save thousands of man-years of research and development.

In brief, the USSR has set high goals for itself and realizes that these can be met only with the help of the most recent Free World equipment and technology. The attainment of these goals will play a major part in the economic competition of the USSR with the US.

### C. Appendix

The attached exhibit gives the latest available intelligence information on the status of USSR production of the types of end products made by the petrochemical plants included in the USSR "shopping lists."

1. Polyethylene and Polypropylene

So far as is known, the USSR is producing only pilot plant quantities of high-pressure polyethylene; the production rate being about 2,500 metric tons per year at the Leningrad plant and additional, presumably smaller quantities are produced at experimental installations. Low pressure polyethylene is still in the laboratory stages, but the Soviets claim to be building a plant to produce 15,000 tons a year.

Having vast supplies of raw materials available, the Soviets appear to be planning to make large quantities of these plastics. However, the numerous references appearing in the Soviet press and technical journals are vague, using such expressions as, "production has been organized," "production will be put into operation," "a plant will be built," etc. The same expressions have appeared for the past several years. In January it was reported that an equipment firm in the USSR would build "a machine for making polyethylene."

A member of the Soviet plastics delegation which visited England in 1957 admitted that the USSR was short of equipment needed for making high-pressure polyethylene. When the delegation attempted to purchase the technology for making low pressure polyethylene in West Germany, the statement was made that they could pay any price for this information since it would save them five years in getting into production. Although the USSR is continuing to make every effort to procure polyethylene production equipment and technology, there have been no reports of a deal having been consummated thus far.

Polypropylene production according to Soviet press reports is only in the laboratory stage. Bloc countries usually experience a considerable lag, normally five to ten years, between laboratory or pilot-plant production and commercial operations. If the USSR hopes to attain volume production of these types of plastics in the foreseeable future, it appears necessary that both equipment and technology will have to be purchased from the West.

2. Caprolactam

In the field of nylons, the principal production in the USSR is the Nylon-6 type, with only very small quantities of Nylon 6/6 being made. Main uses are for tire cord for truck and aircraft tires, and parachute cloth and shroud lines. Since production of both types is limited - estimated at about a total of 8,500 tons in 1955 - very little is used for consumer goods and molded items are apparently made only for very special applications. Since the raw materials for caprolactam - benzol and cyclohexane - are available in ample amounts and the technology of manufacture is well established, the Soviets appear to be more interested in expanded Nylon-6 production.

A goal of 10,000 tons of Nylon-6 tire cord has been announced for 1960 and can probably be realized if the project is given sufficient priority.

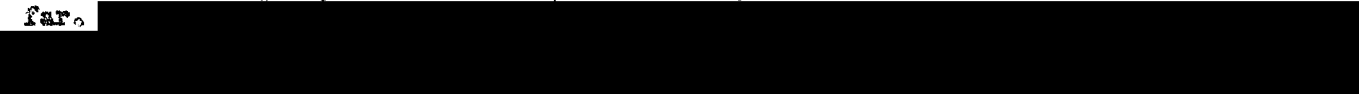
3. Polyacrylonitrile

The Rumanians were negotiating with Chemstrand Co. for the purchase of a plant and the technology for the entire process of making "Acrilan," a

polyacrylonitrile fiber. According to the latest information, Chematrand has called off the negotiations. The Soviets have been interested for several years in producing this type of fiber as a possible substitute for wool and fur garments. Currently they are believed to be making it on a small scale, and plans call for the production of 5,000 tons by 1960. Since the basic raw materials can be made from petrochemical sources, the Soviets have ample potential supplies on which to base production.

#### 4. Polyvinylpyrrolidone

It was announced in 1955, that Russian researchers had worked out a method for the production of polyvinylpyrrolidone, an extender for blood plasma which can be stored for emergency use. However, no actual production has been announced thus far.



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#### 5. Phthalic Anhydride

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The traditional German technology for the manufacture of phthalic anhydride from naphthalene is well known to chemical engineers in the USSR and recently the Soviets have announced that a new process had been developed which would reduce the capital investment needed for making this material from xylene. The latter is presently being obtained from coke chemical sources. Although no reference has been seen indicating that the Russians are making xylene from petroleum, they are probably able to do so. However, there is some doubt whether they are able to extract the xylene fraction necessary for this advanced process. It would appear that Soviet interest in the US technology is primarily in the use of moving-bed catalysts, which would be applicable to other manufacturing processes. There has been no previous reference to the expansion of phthalic anhydride production as a part of the program for developing the petrochemical industry.

#### 6. Maleic Anhydride

Russian technical literature has made only casual reference to this material, and there is no direct evidence that its production is considered to be a high-priority project.

#### 7. Melamine

East Germany has produced melamine for several years and the Soviets are believed to be producing small amounts on a pilot plant scale only. A large "shop" for its manufacture is reported to be under construction.

#### 8. Acrylonitrile

It is believed that acrylonitrile is one of the materials which the Soviets plan to expand greatly during the next seven years. From their standpoint this is a desirable operation since the technology of production from petroleum sources, which has been developed and is well established in the United States, would eliminate

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the need for using calcium carbide which is costly in terms of electric power requirements. The acquisition of the latest design information would form the basis for an important petrochemical operation which would provide large quantities of intermediates for plastics, fibers, and synthetic rubber, without drawing on supplies of vitally needed raw materials.

9. Hexamethylene Diamine

To date very little has been published in the USSR on the use of plastic nylon for the manufacture of machine parts, the principal interest in Nylon 6/6 being in the fiber field. Current production is believed to be very small; thus the acquisition of a hexamethylene diamine plant would help Soviets make good on their promises of more consumer goods without adding to the burden on their equipment industry. The technology for the synthesis of hexamethylene diamine was developed and is closely held by a United States firm (Dupont).

10. Acetylene

According to Soviet publications the problem of making acetylene from methane has been under study for some ten years, with little progress being made during that time. So far as is known there is no commercial production in operation. The Wulff process, for example, with the concurrent production of ethylene, would have an added attraction to the Soviets' program for establishing a petrochemical industry.

11. Ethylene

There have been recent references in the Soviet literature to difficulties being experienced from impure ethylene. These seem to confirm the problems being encountered in getting their petrochemical industry into operation. Availability of the equipment and technology required to extract hydrogen sulfide from natural gas to obtain ethylene of the desired purity would serve the double purpose of providing high purity ethylene and augmenting the supply of elemental sulphur.

12. Foam Polyurethane

The USSR has just recently announced "the mastery of the method for making foam polyurethane." Since this announcement refers to a laboratory accomplishment, however, it is believed that commercial production will require a considerable period of time, unless the Russians are successful in purchasing the technology and equipment from the West. The urethane itself would be useful as a missile fuel after the incorporation of an oxidant.

13. Synthetic Rubber

Until recently the Russians made only divinyl rubber - from sodium-polymerized butadiene - for all general-purpose applications. The butadiene was produced mainly from fermentation alcohol. Thus their synthetic rubber industry constituted a serious drain on supplies of foodstuffs. Recent developments include the

production of alcohol from wood hydrolysis and lately from refinery gases. Also a limited amount of rubber is being made as a butadiene/styrene copolymer, similar to our Government Rubber Styrene (GRS). Small amounts of "cold" rubber and oil-extended rubber have also been produced of late. Attempts at making black master-batch synthetic have been noted but this process is not known to be in commercial use. Since divinyl rubber is inferior to GRS, the Russians are interested in the latest methods for producing GRS which will enable them to make both types of rubber in the same plant. Further, from the cost data which have been published, Soviet synthetic rubber is much more expensive than natural rubber. There is no doubt that the Communists hope to improve the quality and cost of their synthetic rubber through the acquisition of the latest US technology. Not the least of the advantages to be derived from this technology would be the information gained on automation and instrumentation of synthetic rubber production, which knowledge would be transferable to other projects.

There has been no indication in the Soviet technical literature that synthetic rubber is actually used as a binder for missile propellants.

14. Moltopren

The Soviets claim to have three plants producing foam sheet, although the raw material used is not stated. It is probable that the bulk of foam sheet made is from polyvinylchloride. The term "porolon" is similar to both the German and Russian terms for "porous," so it is assumed that "porous moltopren" is meant.

15. Sulphur

The largest oil-producing area in the USSR is the Second Baku Field which yields high-sulphur crudes. The Russian effort to purchase a small sulphur extraction plant from the United States appears to be motivated by the expectation that the technology involved would be transferable to other processes. It would seem that the Russians would be interested in applying the advanced technology used in purifying ethylene to the purification of other petroleum products.

16. Carbon Black

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The Russian primary interest in carbon black is the improvement of their tires, the quality of which is low by US standards. More than half their tire failures are attributed to poor tread quality. For the past several years the Russians have been attempting to improve this deficiency. Supplies of high abrasion black would definitely help.

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One of the objectives of the Sixth Five-Year Plan (1956-1960) was to place such a plant in production.

17. Di-isocyanates

The Russians claim to have started the production of foamed polyurethane in 1957. The volume is unstated, but is probably small, since in 1956 the scientists

responsible for developing the process were criticized for delaying production by their failure to deliver technical data to the plant. There have been no reports of the production of di-isocyanates being made in the USSR, although it is known that the East Germans were conducting research on these materials in 1955.

18. Titanium Dioxide

Soviet technology in the manufacture of this material is reported to be about on a par with that of the US, although there have been complaints in the Soviet press on the pigment quality of domestic titanium dioxide. Their raw materials supplies are practically unlimited. No strategic advantage can be seen in withholding the export of a plant for making this product.